	Application No.	Applicant(s)
Notice of Allowability	10/607,027	SERIZAWA, KAZUYOSHI
	Examiner	Art Unit	
	Thanh D. Vo	2189	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the Amendement filed on March 2, 2006 and the telephone interview on May 10, 2006*.

2. ☒ The allowed claim(s) is/are *1-3, 5-10, 12-16, 18 and 19*.

3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a) ☒ All   b) ☐ Some*   c) ☐ None   of the:

        1. ☒ Certified copies of the priority documents have been received.

        2. ☐ Certified copies of the priority documents have been received in Application No. _____ .

        3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the

             International Bureau (PCT Rule 17.2(a)).

    * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.

    (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached

        1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____ .

    (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of

         Paper No./Mail Date _____ .

    Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)

2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)

3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____

4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material

5. ☐ Notice of Informal Patent Application (PTO-152)

6. ☒ Interview Summary (PTO-413), Paper No./Mail Date _____ .

7. ☒ Examiner's Amendment/Comment

8. ☑ Examiner's Statement of Reasons for Allowance

9. ☐ Other _____ .

DETAILED ACTION

1.   This Office Action is responsive to the Amendment filed on March 2, 2006 and a

telephone interview on May 10, 2006. Claims 1-3, 5-9, 12, 14-19 have been amended.

Claims 4, 11, and 17 have been canceled. Claims 1-3, 5-10, 12-16, and 18-19 are now

in the condition for allowance.

EXAMINER'S AMENDMENT

2.   An examiner's amendment to the record appears below. Should the changes

and/or additions be unacceptable to applicant, an amendment may be filed as provided

by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be

submitted no later than the payment of the issue fee.

        Authorization for this examiner's amendment was given in a telephone interview

with John R. Mattingly (Reg. No. 30,293) on May 10, 2006.

3.   The application has been amended as follows:

Claim 1. (Currently Amended) A storage allocation method for allocating a vacant

storage region to a virtual volume from storage regions of at least one of storage

devices when storage regions maintained by the storage devices are provided as

virtualized volumes to a host computer, said method comprising:

        a first step of allocating a storage region for a required size to be allocated from

said vacant storage region so that a remaining unallocated part of the required size to

be allocated becomes smaller than a specified maximum region size of the vacant

storage region; and

a second step of, when said remaining unallocated part of said required size to

be allocated becomes smaller than said <u>specified</u> maximum region size of the vacant

storage region, acquiring a storage region having a size that is a smallest increment of

the power of two that is not smaller than said remaining unallocated part of the required

size from said vacant storage region for allocation<u>; and</u>

<u>a third step of, sorting the vacant storage region into a plurality of groups and</u>

<u>dividing the virtual volume into a plurality of divisions for load dispersion among the</u>

<u>plurality of divisions and dividing the required size to be allocated according to a</u>

<u>specified number of divisions and assigning the divided required size to be allocated</u>

<u>respectively to the plurality of groups for allocation.</u>

Claim 2. (Currently Amended) A storage allocation method according to claim 1, further

comprising a <u>fourth</u> third step of, if said vacant storage region includes a plurality of

continuous vacant regions, selecting the <u>a</u> largest continuous vacant region for

allocation.

Claim 3. (Currently Amended) A storage allocation method according to claim 1,

further comprising a <u>fourth</u> third step of, if said vacant storage region adjoins an

allocated storage region on each side thereof, acquiring for allocation a storage region

adjoining the allocated storage region which is less likely to be released.

Claim 4. (Canceled)

Claim 5. (Currently Amended) A storage allocation method according to claim 1 [[4]] wherein in said third step, if the number of said groups is greater than said number of divisions, the divided required sizes to be allocated are respectively assigned to the selected groups in decreasing order of the total vacant capacity for allocation.

Claim 6. (Currently Amended) A storage allocation method according to claim 1 wherein the first step further allocating allocates a largest region [[,]] whose size is an integer times said specified maximum region size and not exceeding said required size to be allocated [[,]] from said vacant storage region.

Claim 7. (Currently Amended) A storage allocation method according to claim 1 wherein the first step further allocating allocates the a largest region [[,]] whose size is a power of two not exceeding said required size to be allocated [[,]] from said vacant storage region.

Claim 8. (Currently Amended) A virtualization device which provides storage regions maintained by at least one storage device to a host computer as virtualized volumes, said virtualization device comprising:

access translation table means for storing information on associativity between an address of each storage region on a virtual volume and the addresses of a

corresponding logical unit in the storage device and a corresponding storage region in said logical unit;

means for translating an input/output request for said virtual volume into an input/output request for the storage region of said storage device with reference to said access translation table means;

means for accepting a request to allocate a vacant storage region to said virtual volume from storage regions of said storage device;

means for allocating a storage region for a required size to be allocated from said vacant storage region so that remaining unallocated part of the required size to be allocated becomes smaller than a specified maximum region size of the vacant storage region;

means for acquiring a storage region, having a size that is a smallest increment of the power of two that is not smaller than said remaining unallocated part of the required size to be allocated, from said vacant storage region for allocation when said remaining unallocated part of the required size becomes smaller than said specified maximum region size of the vacant storage region; and

means for sorting the vacant storage region into a plurality of groups and dividing the required size to be allocated according to a specified number of divisions and assigning the divided required size to be allocated respectively to the plurality of groups for allocation; and

means for, after storage allocation is completed for the request to allocate said

vacant storage region allocation request, updating a content of said access translation

table means based on the an allocation result.

Claim 9. (Currently Amended) A virtualization device according to claim 8, further

comprising means for, if said vacant storage region includes a plurality of continuous

vacant regions, selecting the a largest continuous vacant region for allocation.

Claim 10. (Original) A virtualization device according to claim 8, further comprising

means for, if said vacant storage region adjoins an allocated storage region on each

side thereof, acquiring for allocation a storage region adjoining the allocated storage

region which is less likely to be released.

Claim 11. (Canceled)

Claim 12. A virtualization device according to claim 8 11, further comprising means for,

if the number of said groups is greater than said number of divisions, the divided

required sizes to be allocated are respectively assigned to the selected groups in

decreasing order of the total vacant capacity for allocation.

Claim 13. A storage device incorporating the virtualization device according to claim 8.

Claim 14. A computer readable storage medium storing a program executing a

method on a computer to implement a method ~~capability~~ of providing storage regions

maintained by storage devices as virtualized volumes to the computer and a method

~~capability~~ of allocating a vacant storage region to a virtual volume from storage regions

of at least one storage device, said method ~~capability~~ of allocating vacant storage

comprising the steps of:

allocating a storage region for a required size to be allocated from said vacant

storage region so that a remaining unallocated part of the required size to be allocated

becomes smaller than a specified maximum region size of the vacant storage region;

~~and~~

when said remaining unallocated part of the required size to be allocated

becomes smaller than said specified maximum region size of the vacant storage

region, acquiring a storage region having a size that is a smallest increment of the

power of two that is not smaller than said remaining unallocated part of the required

size to be allocated [[,]] from said vacant storage region for allocation; and

sorting the vacant storage region into a plurality of groups and divide the virtual

volume into a plurality of divisions for load dispersion among the plurality of divisions

and dividing the required size to be allocated according to a specified number of

divisions and assign the divided required size to be allocated respectively to the

plurality of groups for allocation.

Claim 15. The [[A]] program according to claim 14, further selecting a largest

continuous vacant region for allocation allowing the computer to, if said vacant storage

region includes a plurality of continuous vacant regions, select the largest continuous

vacant region for allocation.

Claim 16. The [[A]] program according to claim 14, further acquiring for allocation a

storage region adjoining the allocated storage region which is less likely to be released

allowing the computer to, if said vacant storage region adjoins an allocated storage

region on each side thereof, acquire for allocation a storage region adjoining the

allocated storage region which is less likely to be released.

Claim 17. (Canceled)

Claim 18. The [[A]] program according to claim 14 17, further assigning the divided

required size to be allocated respectively to a group in the plurality of groups in

decreasing order of the total vacant capacity for allocation allowing the computer to, if

the number of said plurality of groups is larger than said number of said plurality of

divisions, assign the divided require sizes to be allocated respectively to the selected

groups in decreasing order of the total vacant capacity for allocation.

Claim 19. (Currently Amended) A system comprising:

at least one storage device maintaining a real storage region;

at least one host processor which initiates data read and write from and to said

real storage region of said storage device;

a virtualization device which interferes between said host processor and said

storage device and provides virtual volumes to said host processor; and

a management console which issues a request said virtualization device to

allocate a storage region for a virtual volume;

wherein said virtualization device comprises:

access translation table means for storing information on associativity between

an address of each storage region on the virtual volume and the addresses of a

corresponding logical unit in the storage device and a corresponding storage region in

said logical unit;

means for translating an input/output request for said virtual volume into an

input/output request for the storage region of said storage device with reference to said

access translation table means;

means for accepting from said management console a request to allocate a

vacant storage region to said virtual volume from storage regions of said storage

device;

means for allocating a storage region for a required size to be allocated from said

vacant storage region so that a remaining unallocated part of the required size to be

allocated becomes smaller than a specified maximum region size of the unallocated

storage region;

means for acquiring a storage region having a size that is a smallest increment of

the power of two that is not smaller than said remaining unallocated part of the required

size to be allocated [[,]] from said vacant storage region for allocation when said

remaining unallocated part of the <u>required</u> size becomes smaller than said <u>specified</u>

maximum region size of the vacant storage region;—and

<u>means for sorting the vacant storage region into a plurality of groups and dividing</u>

<u>the required size to be allocated according to a specified number of divisions and</u>

<u>assigning the divided required size to be allocated respectively to the plurality of</u>

<u>groups for allocation; and</u>

means for updating a content of said access translation table means based on

the <u>an</u> allocation result after storage allocation is complete<u>d</u> for the allocation request.

Reasons for Allowance

4.   The following is an examiner's statement of reasons for allowance:

Claims 1-3, 5-10, 12-16, and 18-19 are now in the condition for allowance for the

following reasons:

Blandy et al. disclosed a storage allocation method and a computer program for

allocating a vacant storage region to a virtual volume from a plurality of storage regions

(See Fig. 1, item 160) comprising at least one of storage devices (See Fig. 1, item 162)

wherein the storage devices provide the storage regions as virtualized volumes (See

Fig. 1, item 167) to a host computer (See Fig. 1, col. 4 starting from line 21, and

Abstract), said method comprising:

a first step of allocating a storage region for a required size to be allocated from

said vacant storage region so that a remaining unallocated part of the required size to

be allocated becomes smaller than a specified maximum region size of the vacant

storage region (see col. 3, lines 32-46, wherein the step of allocating a storage region

to a specified required size as long as the unallocated storage region is able to

accommodate the request);

a second step of, when said remaining unallocated part of said required size to

be allocated becomes smaller than said specified maximum region size, acquiring a

storage region having a size that is a smallest increment of the power of two that is not

smaller than said remaining unallocated part of the required size from said vacant

storage region for allocation (see Fig. 3, col. 9 lines 66 – col. 10 lines 24, wherein the

power of two is an inherent feature since the logic data bit in computer architecture is

always a power of two);

Blandy et al. failed to teach a third step of, sorting the vacant storage region into

a plurality of groups and dividing the virtual volume into a plurality of divisions for load

dispersion among the plurality of divisions and dividing the required size to be allocated

according to a specified number of divisions and assigning the divided required size to

be allocated respectively to the plurality of groups for allocation.

Obara et al. taught a method of balancing the loads across a plurality of disk

controllers, disk devices and sub disk controllers, wherein each storage is divided into

plurality of logical volumes and each storage is coupled to a disk controllers. The method of Obara et al. will allow the accessing load to be evenly distributed across the storage regions and divisions of a storage device. See col. 2, lines 12-20, and col. 8, lines 50-63; and Fig. 6(a,b).

However, neither Bland et al., Obara et al., nor prior art records disclosed a method of sorting the vacant storage region into a plurality of groups and dividing the virtual volume into a plurality of divisions and dividing the required size to be allocated according to the specified number of divisions and assigning the divided require size to be allocated respectively to the plurality of groups for allocation.

In light of the foregoing, claims 1, 8, 14, and 19 of the present invention are found to be patentable over the prior art records. Claims 2-3 and 5-7 are depending from claim 1, claims 9-10 and 12-13 are depending from claim 8, and claims 15-16, and 18 are depending from claim 14, therefore, they are allowable for depending from based claims that are allowable.

5.   Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."
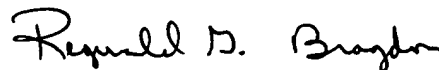
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanh D. Vo whose telephone number is (571) 272-0708. The examiner can normally be reached on M-F 9AM-5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Reginald G. Bragdon can be reached on (571) 272-4204. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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5/12/2006

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